Soil Conservation

November 1977

U.S. Department of Agriculture

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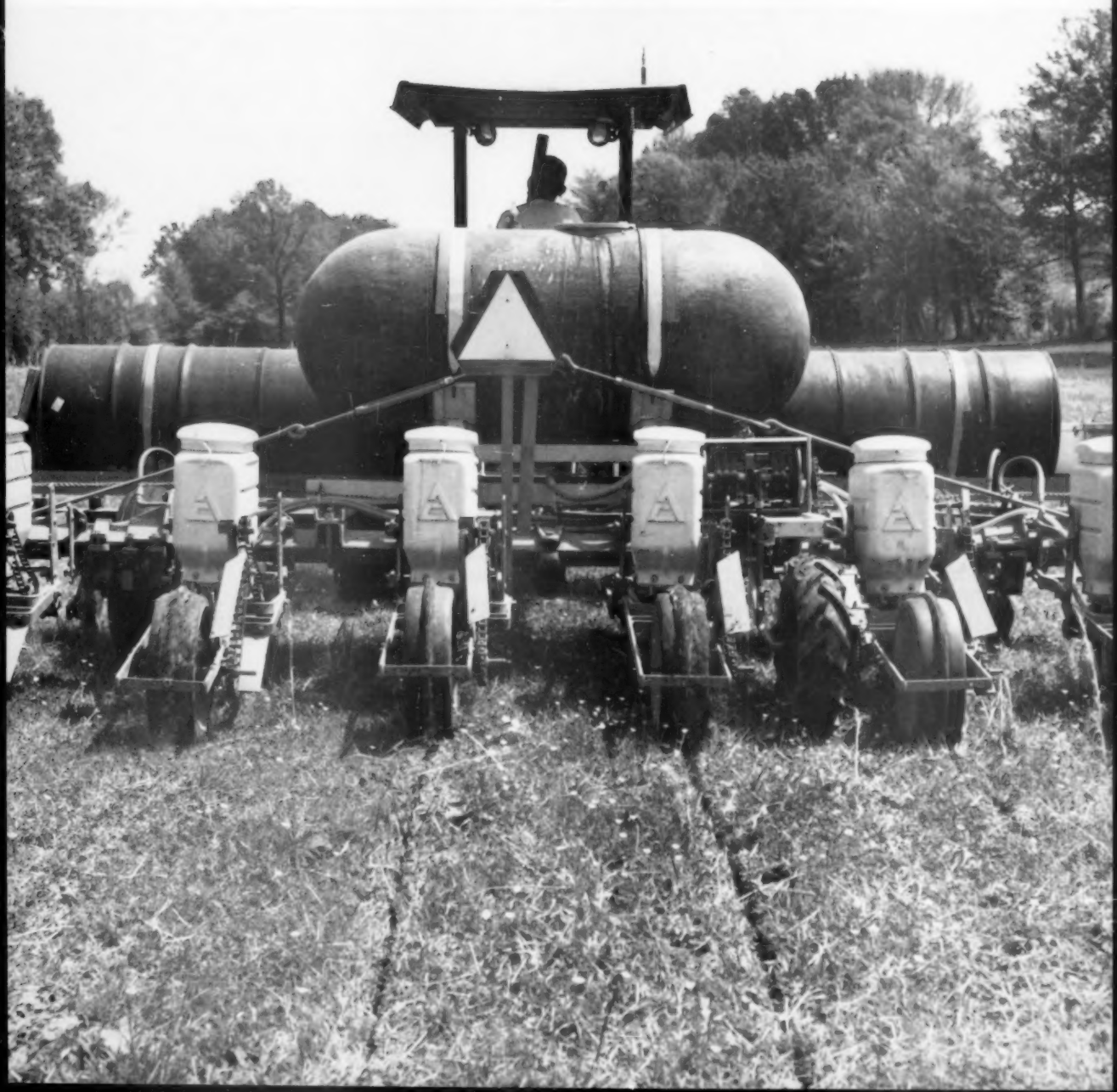

From the Administrator

Saving Energy, Soil, and Water

The men and women who use America's land wisely save energy along with soil and water.

As an article in this issue points out, soil conservation practices and systems could save 1 of every 7 gallons of fuel used in U.S. agriculture.

That is one more reason why soil and water conservation makes good sense. SCS and local conservation district leaders need to pass the word to every corner of our Nation. Potential energy savings might encourage more people to say "yes" to good land use.

Less energy is needed if we keep soil in place on the land than if we have to dredge it out downstream, bulldoze it off streets, or filter it out of water supplies.

Less energy is needed if we keep fertilizers and agricultural chemicals in place on the land than if we have to remove them as pollutants somewhere else and then manufacture, transport, and spread more chemicals to keep the land productive.

Less energy is needed if we recycle animal wastes for plant nutrients right there on the farm or ranch than if we substitute manufactured fertilizers.

Less energy is needed if we add the right amount of water at the right time through a good irrigation system than if we waste half of what we pump.

Less energy is needed if we use minimum tillage than if we clean till the fields.

Less energy is needed if we keep prime farmland in production than if we replace it with land that needs clearing, draining, terracing, irrigating, or more added nutrients.

Other conservation practices may not reduce energy needs directly but do make it possible to grow more food and fiber without increasing energy use.

Not all conservation practices will succeed everywhere under all conditions. Many will call for more careful management by the land user. Most of them will call for an investment that won't be repaid immediately.

SCS and conservation district people can help each land user figure out the practical ways to save soil, water, and energy while making a living . . . and then help put conservation plans into practice.

Mel David

November 1977, Vol. 43, No. 4

Soil Conservation is the official magazine of the Soil Conservation Service. The Secretary of Agriculture has determined that publication of this periodical is necessary in the transaction of public business required by law of the Department. Use of funds for printing *Soil Conservation* has been approved by the Director of the Office of Management and Budget through July 31, 1978.

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Washington, D.C. 20013

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Subscriptions
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Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Cover:
Minimum tillage saves fuel by reducing the number of tillage trips across the field. For six other ways to save energy through soil and water conservation, see the article beginning on page 4.

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Seven Ways Conservation Saves Energy

by Roy M. Gray
and Glen E. Black

A slot-type planter is used to plant soybeans in wheat stubble. Energy savings can be achieved by using conservation tillage, which eliminates use of the moldboard plow and reduces the number of tillage trips.

The conservation plan—after years of showing the way to control erosion and water pollution—is finding its place in energy conservation efforts on farms and ranches.

Farmers and ranchers searching for ways to cut energy costs should take a close look at some of the most popular soil and water conservation management systems. Conservation practices that make up these systems not only conserve soil and water, they also conserve fuel—and in substantial amounts.

Energy costs have nearly doubled in the last 10 years. The price of fuel—gasoline, diesel, natural, and LP gas—will continue to rise and local or regional shortages are likely.

Seven conservation practices have the potential to save more than 1 billion gallons of fuel a year—or 1 of every 7 gallons needed for agricultural production in the year 2000.

The practices—minimum tillage, improved irrigation, pasture management, waste management, parallel terracing, windbreaks, and controlling soil saturation on cultivated land—would boost fuel efficiency by cutting fuel needs per acre or by increasing crop yields per acre, or both.

Minimum Tillage

Of the seven, minimum tillage offers the greatest potential for energy savings. This newer practice has grown in use from 3.8 million acres in 1963 to about 40 million today.

Although the practice varies considerably, it reduces the total number of tillage trips across the field. Roughly tilled land with large amounts of crop residue left on the surface is effective in controlling soil erosion and conserving moisture. Studies show a reduction of 50 percent or more in soil loss over conventionally tilled fields. "Conservation tillage" basically eliminates use of the moldboard plow and achieves even greater energy benefits. It involves use of a slot-type planter in an undisturbed seedbed and use of chemicals for weed and pest control.

In addition to the conservation advantages, farmers have significantly reduced both fuel and labor inputs by shifting from conventional to minimum tillage. A USDA Extension Service study shows that in 1974, per-acre fuel

Energy costs could be saved by more precise scheduling of water through sprinkler irrigation systems.

Water efficiency could be increased as much as 10 percent just by better management practices to apply irrigation water at the proper time and in the proper amount.

and labor costs for conventional tillage averaged $6.11 compared with $3.43 for minimum tillage. Fuel costs were reduced almost 54 percent.

Fuel savings and conservation benefits make two strong selling points in encouraging farmers to practice minimum tillage.

USDA's Office of Planning and Evaluation in its report, "Minimum Tillage: A Preliminary Technology Assessment," projected that as much as 81 percent of U.S. cropland could be minimum tilled by the year 2000. Fuel savings would amount to 760 million gallons a year, or 9 percent of the total energy now used in agriculture.

Improved Irrigation

The second greatest potential for energy savings lies in improving efficiency of irrigation water use—to reduce the amount of water pumped per acre.

Irrigation efficiency in the United States is about 50 percent. This does not mean that half the water pumped

A well-designed irrigation system that uses water more efficiently—thus causing less erosion and pollution damage—greatly reduces energy needs.

for irrigation is lost. It just is not used properly. Much of it is recycled back into the irrigation supply as waste or tailwater. Water applied at too high a rate and in too great a quantity can result in serious soil losses or water logging. Surplus tailwater carries sediment, herbicides, and nutrients that adversely affect water quality downstream.

A well-designed system that uses irrigation water more efficiently—and thus causes less erosion and pollution damage—also greatly reduces energy needs. Proper design of irrigation systems involves careful evaluation of soils, topography, amount of available water, types of crops to be irrigated, and the water delivery system.

The Soil Conservation Service Special Projects Division, for the 1975 National Water Assessment, projected irrigation water uses for the years 1985 and 2000 under a normal level of development and under high efficiency levels.

Under high efficiency levels, water diversions by 1985 could be reduced by 55.8 million acre-feet a year, saving 231.2 million gallons of fuel yearly.

To achieve these savings would require an accelerated program of updating irrigation systems and improving water management through irrigation piping, ditch lining, and land leveling using the best practical technology available. It would require cash outlays for improving 28,000 miles of off-farm canals and laterals and 20 million acres of onfarm irrigation systems.

Thus, the savings of 231.2 million gallons of fuel a year would be offset

Improved pasture management in the United States could increase forage yields as much as 106 million animal-unit-months. This would lower the amount of fuel used per animal-unit-month substantially.

Liquid manure is applied to alfalfa. Full use of animal waste as fertilizer could mean a lot less energy needed to produce and distribute inorganic commercial fertilizers.

As commercial fertilizer prices rise and shortages persist, more and more farmers will be looking at the value of animal waste as fertilizer.

by the energy needed to make these improvements.

Water efficiency could be increased as much as 10 percent with little or no outlay for capital investment—just by better management practices to apply irrigation water at the proper time and in the proper amount. This would save 75 to 80 million gallons of fuel yearly.

A Nebraska study estimated that $7.1 million in energy costs could be saved per year through more precise scheduling of water through sprinkler irrigation systems in the State.

Pasture Management

Improved pasture management in the United States could increase forage yields as much as 106 million animal-unit-months (an AUM is the amount of forage required to feed 1 mature beef animal or its equivalent for 1 month). This would lower the amount of fuel used per AUM substantially, even though it takes more energy to manage a pasture well. The indirect savings would be about 58 million gallons of fuel per year.

An added benefit of good pasture management that leads to energy savings is the lowering of nitrogen needs by adding legumes to the grass mixture.

In addition to saving energy, good pasture management provides permanent vegetative cover which is an extremely effective method of controlling soil erosion.

Waste Management

Full use of animal waste as fertilizer could mean a lot less energy needed to produce and distribute inorganic commercial fertilizers. Proper handling of waste also would greatly reduce pollution in streams, rivers, and lakes.

U.S. farmers and ranchers now use 8 million tons of commercially produced nitrogen, 4 million tons of phosphorus, and 4 million tons of potassium each year.

If just the waste from feedlots were used as fertilizer, the nutrient value would equal 22.5 percent of the commercial nitrogen used yearly, 17.6 percent of the phosphorus, and 30.7 percent of the potassium. It is difficult to estimate the net energy savings from waste management because there is not enough data available on the quantities of waste used.

In 1974, the Texas Governor's Energy Advisory Council did an animal waste study in feedlots of the High Plains. All the waste produced was being used for fertilizer. This amounted to a net energy savings of the equivalent of 20.5 million gallons of gasoline that year.

In low rainfall areas parallel terraces and contour farming save energy by preventing water losses from high intensity storms, making more of the rainfall available for crop use.

In addition to reducing fuel needs, windbreaks protect livestock. Feedlot operators in South Dakota report that cattle protected by a tree belt gained 2½ pounds a day during winter compared with the usual 1 to 1½ pounds for cattle kept in other feedlots.

As commercial fertilizer prices rise and shortages persist, more and more farmers will be looking at the value of animal waste as fertilizer.

Parallel Terraces

Parallel terraces, like contouring and standard terraces, are extremely effective in controlling erosion. They are essential on many acres if cultivated crops are to be raised.

In most areas, contour farming and standard terraces are energy users because resulting increases in farming time are not completely offset by increases in crop yields. Parallel terraces and contour farming do save energy in low-rainfall areas like the Great Plains by preventing water losses from high intensity storms, making more of the rainfall available for crop use.

Windbreaks

Farmstead and feedlot windbreaks protect buildings from cold winter winds and reduce fuel needs.

Farmstead and feedlot windbreaks protect buildings from cold winter winds and reduce fuel needs . . . cutting heating costs as much as 30 percent.

Farmstead windbreaks have cut heating costs as much as 30 percent.

Feedlot operators in South Dakota report that cattle protected by a tree belt gained 2½ pounds a day during winter compared with the usual 1 to 1½ pounds for cattle kept in other feedlots.

Unfortunately, farmstead and feedlot windbreaks are not established overnight. It may be years before full benefits are achieved, but this is not deterring many farmers and ranchers. In 1976, farmers in North Dakota planted 2,600 acres of farmstead and feedlot windbreaks, according to an article in the July-August 1977 issue of *The Furrow*.

Fred Atcheson, Kansas State extension forester, said he prepared more than 100 plans for new windbreaks in the first 6 months of 1977, nearly all of them to protect farmsteads or cattle. "I've never seen more interest in these kinds of plantings."

Controlling Soil Saturation

Poorly drained cultivated land consumes more fuel per unit produced than the same soil with adequate drainage; soggy land delays planting, and delay means lower yields.

In the central Corn Belt, research showed that for each day planting is delayed from May 1 through May 15, yields drop 1 bushel an acre. Each day's delay during the rest of May reduces yields 2 bushels an acre, yet the amount of fuel used remains the same.

Saturated soil also increased the threat of erosion and flooding since rainfall is forced to run off. Appropriate

Plastic tubing is installed on cultivated land to control soil saturation.

The seven conservation practices boost fuel efficiency by cutting fuel needs or increasing crop yields, or both.

The practices offer a way for agriculture to join the country's energy conservation thrust while protecting our Nation's soil and water resources.

subsurface water-removal systems provide a 2-foot "sponge" at the top of the soil profile through which rainfall can be absorbed and safely discharged. Subsurface water-removal systems also help control salinity in arid regions by helping salts leach out more easily.

The last National Inventory of Soil and Water Conservation Needs showed that more than 40 million acres of tilled cropland had soil saturation problems. This involved only Class I and II wetlands. Improving soil moisture conditions on these acres would save more than 160 million gallons of fuel and would increase yields as much as if more than 14 million more acres were farmed.

Potential fuel savings from improved soil moisture conditions on cultivated lands vary considerably among States. More than 54 percent of the total could be saved in just four States: Indiana (17.9), Minnesota (16.7), Ohio (10.8), and Illinois (8.8).

To determine net energy savings, fuel requirements for installing and maintaining the water-removal systems would need to be computed and distributed across the expected life of the measures. However, improving drainage of cultivated lands could be an economical and environmentally sound way to increase U.S. output of food and fiber without clearing pasture and woodlands and without draining areas that are not being cropped.

Potential for Energy Savings

Since the Nation's 2½ million farms and ranches consume only 3 percent of energy used in the country, soil and water conservation practices certainly are not the only answer to U.S. energy problems.

The practices do, however, offer a way for those who work in agriculture to join the country's energy conservation thrust while also protecting our Nation's natural soil and water resources.

They also offer farmers and ranchers some relief from the soaring costs of fossil fuels.

Mr. Gray is director, economics division, SCS, Washington, D.C.
Mr. Black is chief, conservation planning branch, conservation operations division, SCS, Washington, D.C.

During the Midwest convention of the National Association of Farm Broadcasters, Bruce Lease (left), farm director at a Minnesota radio station, conducts a live interview with Leroy Swenson, president of the Minnesota State Association of Conservation Districts. The convention included a conservation tour to give the broadcasters a firsthand look at conservation techniques. District officials explained land treatment at the Lakes Okabena and Ocheda Small Watershed Project near Worthington, Minn.

Conservation on the Air

by Thomas C. Gahm

By their own admission, the people who broadcast farm news have a limited knowledge of soil and water conservation.

"It's not that we're disinterested in conservation," said Jim Wychor, part owner of radio station KWOA in Worthington, Minn. "We do carry a lot of news about it. It's just that broadcasters are on the outside. We don't often see conservation projects firsthand."

In June, Wychor and other farm broadcasters representing more than 80 radio stations in eight States met in Worthington for the annual Midwest regional convention of the National Association of Farm Broadcasters. Part of their convention was a firsthand look at conservation—as guests of the Minnesota Association of Soil and Water Conservation Districts.

The theme of the tour was "How a Community Has Survived on a Waterless Prairie," and district officials guided the broadcasters through the nearly completed Lakes Okabena and Ocheda Small Watershed Project. District supervisors explained the project, from stripcropping, terracing, and other land treatment to how Worthington, a town of 11,000, depends on Lake Bella, a reservoir created as part of the project.

Worthington was thirsty before the watershed project began, district supervisors told the broadcasters. The town is on the divide between the Mississippi River and Missouri River drainage areas, and there are few dependable surface sources of water. A series of shallow wells is the only source of the 3 million gallons of water the town uses each day, and Lake Bella keeps the wells filled by helping to stabilize the supply of ground water.

Wychor, chairman of the Lakes Okabena and Ocheda Watershed Board of Managers in the early stages of the project, told his fellow broadcasters that because of the water supply Lake Bella guarantees, Worthington is no longer in danger of "drying up and blowing away."

The area's two largest food processing industries had decided to stay in Worthington because of the plans in the mid-1960's for providing the town with a stable, long-term water supply. "I don't believe they would have stayed otherwise," said Wychor.

He said that without the watershed project other large water-using industries in the town would have been forced to close last year because of the drought. There just wouldn't have been enough water to go around.

It was a working tour for the broadcasters. Bruce Lease, vice president of the National Association of Farm Broadcasters and farm director at Worthington's KWOA, broadcasted his noon farm program live from the tour. Many of the other broadcasters carried tape recorders and interviewed Leroy Swenson, president of the State Association of Conservation Districts; Harry Major, Soil Conservation Service State Conservationist; farmers; and watershed officials on a variety of soil conservation topics. The interviews were carried on farm programs throughout Montana, North Dakota, South Dakota, Iowa, Wyoming, Nebraska, Wisconsin, and Minnesota.

"Conservationists can be an important source of news and information for farm broadcasters," said Swenson, "and there is absolutely no doubt that they can help us reach the public with our programs by making soil and water conservation more visible. I hope that this meeting will lead to helpful working relationships between conservation districts and farm broadcasters throughout the country."

Mr. Gahm is public information officer, SCS, St. Paul, Minn.

One of the sources of pollution that PLUARG is investigating is lakeshore erosion

An interview with Norman A. Berg,
Associate Administrator,
Soil Conservation Service

What's Happening to Water Quality in the Great Lakes?

When the United States and Canada established the International Joint Commission (IJC) under the Boundary Waters Treaty of 1909, their intent was to prevent disputes over the use of boundary waters. This treaty also provided the framework for cooperation on water-related pollution problems that have been growing progressively worse. In early 1972, under a United States-Canada Great Lakes Water Quality Agreement, the IJC created an International Reference Group on Great Lakes Pollution from Land Use Activities (PLUARG). Soil Conservation Service Associate Administrator Norman A. Berg was appointed U.S. cochairman. The Canadian cochairman is Murray G. Johnson, Director General, Ontario Region Fisheries and Marine Service.

At right, some 40,000 cubic yards of soil washed from a gully into the White River which empties into Lake Superior near Ashland, Wis. Below, homeowners are threatened by shoreline erosion of Lake Ontario.

Question: Stories about loss of water quality in the Great Lakes get big play in the national media. Some say that Lake Erie is dying. How bad is the situation?

Berg: There is nothing new about loss of water quality in the Great Lakes Basin. The International Joint Commission detected it in studies as early as 1912. The process had been accelerating. By the late 1960's, deterioration, especially in Lake Erie, had reached an advanced stage. That provided the big push that led to the 1972 Great Lakes Water Quality Agreement.

"Dying" is too strong a description however. The process is called "eutrophication"—an excessive buildup of aquatic weeds and algae caused by large amounts of nutrients entering the water. If unchecked, eutrophication can turn a body of fresh water into a swamp.

A major nutrient entering the waters of Lakes Erie and Ontario is phosphorus. Much of it is contained in municipal wastes, wastes from fertilizers used on farms and urban lawns, and wastes from detergents and other cleaning agents. The Great Lakes Research Advisory Board reported to the IJC earlier this year that Lake Ontario could respond to reductions in phosphorus loadings in as short a time as 8 years.

Question: How much does land use activity contribute to Great Lakes water-quality problems?

Berg: The Great Lakes drain more than 538,000 square kilometers (about 200,000 square miles) of U.S. and Canadian lands. Of this, about 59 percent is forest land, 33 percent agricultural land, and 6 percent urban development.

Intensively used agricultural lands and urbanizing areas are the most likely to produce nonpoint-source pollutants. For urban areas, the major pollutants are excessive sediment losses from construction sites and discharges of complex wastes during periods of stormwater runoff. Urban areas occupy a relatively small portion of the basin's total land area, but they hold about 80 percent of the population and are generally located near the lakes. For agricultural areas, the major pollutants are eroded soil particles, pesticides, and phosphorus.

In addition, we believe there is a significant "fallout" of airborne pollutants over the entire basin, including the surface of the lakes. Much of this fallout comes from outside the basin, and all of it tends to get widely distributed. These pollutants are created by burning of industrial wastes, by automobile exhausts, and by wind erosion.

Question: What can be done about these nonpoint sources of pollution?

Berg: PLUARG, the International Reference Group on Great Lakes Pollution from Land Use Activities, is trying to answer that question. I serve as the group's U.S. cochairman. We have been operating since 1972, and will file our final report with the IJC in July 1978.

Question: Who serves on PLUARG?

Berg: It has 18 members—nine from each country. They represent both Federal governments, the several States, and the Province of Ontario. The members come from a variety of institutions and government agencies with interests in education, the environment, wildlife, agriculture, and natural resources.

Barge is loaded with sediment dredged from Fox River which empties into Green Bay.

Question: What does PLUARG do?

Berg: The IJC directed us to conduct studies to answer three basic questions:

1. Are the Great Lakes being polluted from land use sources?
2. If so, to what extent, from what specific causes, and where?
3. What remedies are possible and practicable, and how much would they cost?

Question: What progress are you making?

Berg: We didn't have too much trouble with the conclusion that the Great Lakes *are* being polluted by a variety of land uses. PLUARG investigated urban areas; transportation corridors; mining, agricultural, forest, and recreational areas; waste disposal areas; shoreline landfills; and lakeshore and riverbank erosion.

The job of determining extent, cause and effect, and locations is much more difficult. The major land use in the basin—forestry—is not a significant threat. Intensive agricultural and urbanization activities do contribute heavily to water pollution.

Question 3 cannot be answered realistically until we have more complete answers to question 2. Some people think we should answer question 3 first. A practical remedial program at a reasonable cost could make the first two questions academic.

In its research, PLUARG has generated a wide range of technical reports and data, documentation, seminars and library aids, maps, and other materials.

Question: How do you do all this?

Berg: We divided the overall study into four tasks so that we could deal with some questions concurrently.

We designed the first two tasks to define the scope of the problem:

- In task "A," we surveyed the best information available on the effects of land use activities on water quality. We also are documenting all existing remedial measures in the suspected problem areas. PLUARG includes in this task public involvement activities (1) to create public awareness of land-use activities in the Great Lakes Basin and (2) to solicit many different opinions and views. In addition, we are doing a survey of legislation concerned with nonpoint-pollution problems in each jurisdiction.
- In task "B," we compiled an inventory of land use and land-use practices. We attempted to identify trends and to make projections to 1980 and, wherever possible, to the year 2020.

We designed the other two tasks to provide solid evidence for PLUARG's conclusions and recommendations and a scientific, credible base for further work:

- In task "C," we are intensively studying a few representative watersheds in the United States and Canada. Where possible, we will project the data onto similar lands within the entire Great Lakes Basin, relating water pollution to specific land uses and practices. Information also is being gathered on the concentration, storage, and transport of suspected pollutants.
- In task "D," we are attempting to diagnose the degree to which water quality has been impaired in the Great Lakes. We are assessing concentrations of

Top, runoff from a sloping barnyard caused pond to eutrophy. If unchecked, eutrophication can turn a body of fresh water into a swamp. Bottom, a major pollutant in urban areas is excessive sediment loss from construction sites.

contaminants in lake sediments, fish, and other aquatic resources.

Question: What are the public involvement activities in task A?

Berg: PLUARG already has launched a public information and consultation program designed to let the Great Lakes' public know what the lake problems are and how diffuse sources are contributing to these problems. The program also is designed to allow the public to react to alternative solutions.

The nucleus of the information activities is a series of public participation panels—eight in Canada and nine in the United States. Panel members represent a broad cross section of interests. They include private citizens, elected officials, leaders of special interest groups, members of the industrial community, and educators. Up to 20 people serve on each panel. We give them the information we have gathered and ask their opinions on preliminary recommendations. The contributions of these panels will weigh heavily in PLUARG's final report.

In addition, USDA's Statistical Reporting Service (SRS) is conducting personal and telephone interviews with almost a thousand farmers in the basin, asking their views on the relationship between agriculture and pollution in the Great Lakes. As part of this survey, SRS is checking to see what conservation practices are being used and why they have been adopted. A similar study is underway on the Canadian side.

Question: Why so much emphasis on public involvement?

A landowner places 2-ton rocks along the shoreline in an effort to fight erosion on Lake Superior.

Berg: Public support is vital, because few remedies will work without it. The problems are not simply environmental. They are also social, political, and economic.

Question: Isn't PLUARG likely to recommend actions that may also be recommended—at least on the U.S. side—as a result of Section 208 (Public Law 92–500) planning activities, the Army Corps of Engineers' Lake Erie Study, and the Coastal Zone Management Program?

Berg: I wouldn't attempt at this time to predict PLUARG's final recommendations. There are several other current programs with interest in nonpoint sources of pollution. Activities conducted as part of the areawide water quality management plans required under Section 208, for example, are compatible with PLUARG's. So are certain aspects of the Coastal Zone Management Program—and the Corps Study—especially those actions related to erosion and sediment reduction and environmental assessment.

The entire U.S. portion of the Great Lakes Basin is included within Section 208 planning areas. People involved in 208 planning face problems similar to those confronting PLUARG investigators—lack of good water quality data and inadequate literature on the subject, for example. The PLUARG mandate, however, is distinguished by its emphasis on water quality in the Great Lakes. Some pollution problems in upland watersheds may never affect the open waters of the lakes.

One bright spot is that water quality goals are compatible with soil and water conservation goals. Herein lies an unparalleled opportunity to accelerate visible soil conservation while helping to improve the environment. In the United States, soil and water conservation districts are in a unique position to steer such implementation efforts.

Many Canadians have acquired similar experience from watershed and river basin programs in their country. Some of them feel that Canada could benefit from a local district format similar to ours.

Question: What action will the IJC take on PLUARG's final report?

Berg: First, IJC will schedule a series of public hearings to get additional citizen input and to develop public understanding of the problems. Then IJC will decide what recommendations to make to the U.S. and Canadian governments.

There is some concern within PLUARG over who is going to pay the costs of controlling pollutants from land use activities. We intend to make our recommendations as realistic and economically feasible as possible. But legislators, administrators, and resource users will almost certainly question program costs unless they recognize and understand the need for pollution control and the benefits to be derived from it.

Another key ingredient in a successful program will be voluntary participation. This has characterized SCS work for more than 40 years. Many of our goals would be unattainable without it.

In the end, the strength of any public commitment could depend upon how valuable a resource the general public feels the Great Lakes really are.

Below, severe erosion was a problem before installation of an inlet to one of the reservoirs. Right, the reservoir has a 90 acre-foot storage capacity. After 10 years of hard work, area farmers have a dependable water management system.

Long Battle for Short Creek

by Kirk G. Heaton

For more than 50 years, farmers in Colorado City, Ariz., struggled to make the best of a limited water supply. Now they have a water management system to help them.

People in Arizona make good use of water, yet its development and management are a continuous battle.

People in the northern Arizona farming community of Colorado City know what's needed to win the battle for water. Their only aboveground source of water is Short Creek, a tributary of the Virgin River. Surface water flows in the creek only intermittently—about 30 days each year—triggered by snowmelt and summer storms in Utah's Canaan Mountains, by infrequent local storms, and by even less frequent local flash floods.

Colorado City's early settlers recognized Short Creek's potential for irrigation water, but the question was how to develop it.

In 1928, residents formed an irrigation district and established a water right on the creek. But, the amount of irrigable land involved and the size and flow of the creek didn't qualify the region for Bureau of Reclamation funds for water development. So, for 40 years, farmers struggled to build their own irrigation system.

Dan Jessop, who came to Colorado City with his parents in the early 1930's, said, "It was frustrating to see the creek flow right past all our farms and not be able to control it and store the water.

"In 1932 and again in 1941, we almost got water to our fields through a hand-dug diversion ditch. It was a cooperative effort: every able-bodied man and woman in town helped to dig the ditch. Eventually landslides and trash in the runoff blocked the ditch so badly that we had to abandon it."

In 1967, after a small diversion dam had washed out several times, farmers

A gated outlet structure with a stem and debris guard was included in the construction plan.

Water is sprayed to compact clay used to fill 70-foot deep core trench for one of the reservoirs.

Blocks in a concrete chute reduce water speed, solving erosion and sediment problems.

asked the Fredonia Natural Resource Conservation District for help in designing and constructing a permanent water development and management system.

The Soil Conservation Service, working through the conservation district, provided technical assistance, and the Agricultural Stabilization and Conservation Service helped finance the project.

Clifford Parsons, SCS area engineering specialist at Prescott, Ariz., developed a 5-year construction plan for the diversion, storage, and delivery of water from Short Creek to local farms.

The main features of the plan included a semipermanent diversion dam, a special sluiceway, 2 miles of irrigation diversion channels, two storage reservoirs, and more than 10,000 feet of irrigation pipelines. Seven existing irrigation wells and their sump were also included in the plan.

The reservoirs have a combined capacity of approximately 170 acre-feet, and the sprinkler system irrigates 300 acres of cropland. Flood and fire protection are added benefits.

Constructing the system made special demands of Colorado City's farmers. "We weren't contractors or heavy equipment operators," Dan Jessop explained, "and we couldn't afford to hire experienced people to do the work. We asked for bids on some phases of the project, but the bids far exceeded our means. So we did the work ourselves, with heavy equipment that we borrowed from the conservation district."

It took almost 10 years to complete the water management system, and Clifford Parsons marvels at Colorado City farmers' ingenuity and determination.

"They worked through the heat of summer and subzero winters to get the job done," Parsons said. "When heavy equipment broke down they repaired it on the spot."

"The cost per acre-foot of water that we're able to store and use with this system may seem high," Jessop said, "but knowing we can get water when we need it is well worth the cost."

Mr. Heaton is district conservationist, SCS, Fredonia, Ariz.

District Conservationist Don Jackson helps students with soil studies at Camp Redlands.

Oklahoma and its conservation districts invest time and money in conservation education for big environmental dividends.

by F. Dwain Phillips

Learning Inside and Out

Oklahoma supports conservation education statewide. The Pontotoc County Conservation District brought attention to the State effort in 1976 when it won the national NACD-Allis Chalmers Environmental Education Award.

The district's program included funding minigrants for school projects, developing outdoor classrooms, and hiring an environmental education specialist to help individual teachers and schools prepare a course of study for their students and to help them with special projects. The district, in cooperation with a local university, also helped organize a summer course in environmental studies for teachers.

Pontotoc County's program is a good example of what can be done in conservation education by districts. Much is also being done at the State level.

The Oklahoma Conservation Commission helps fund the salaries of two conservation education specialists who help schools in districts throughout the State. It also helps fund minigrants and other programs.

Conservation education is important to the Oklahoma Association of Conservation Districts, too. It actively supports many district programs like the ones in Rogers, Logan, Payne, and Tulsa Counties.

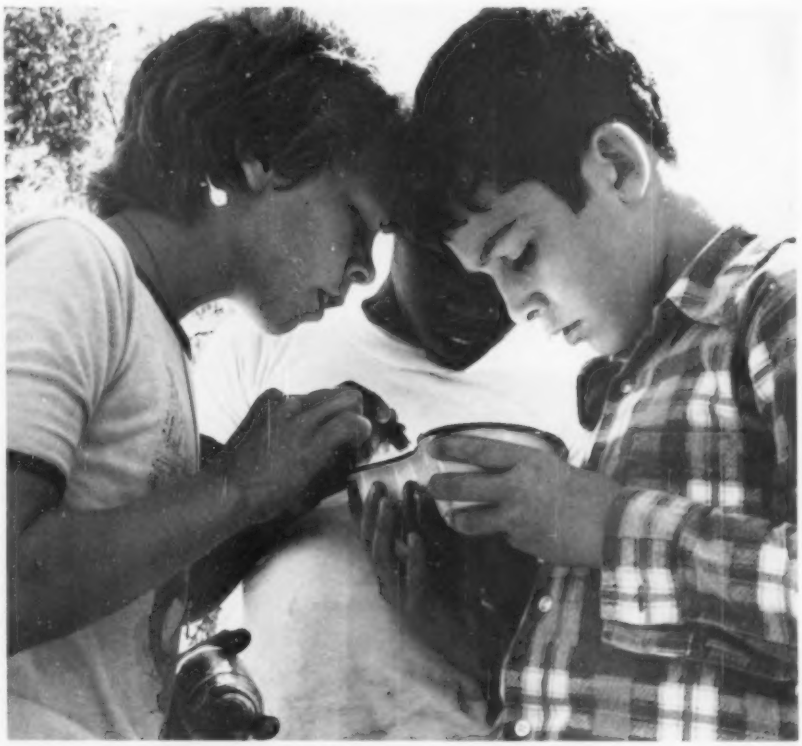
The Rogers County Conservation District gave $1,000 toward developing the Oologah outdoor classroom. It furnished materials for other outdoor classrooms and assigned resource people to help with the projects. Speaking for the district, Chairman Waldo Funk says, "We should have done more to educate our young people years ago. Helping them to understand the environment and learn how to protect our natural resources is good for all of us."

Districts in rural communities are not the only ones working on conservation education. Tulsa County Conservation District—which serves Tulsa, the second largest city in the State—reaches an estimated 7,000 students each year with its conservation education activities. This year the district gave six sets of soils monoliths to schools to use in their lessons on soils and helped 10 schools start outdoor classrooms.

For several years Logan County Conservation District has organized and helped support a 1-week conservation camp for sixth graders. The children have an opportunity to go outdoors to learn about the environment. They study soils and plants with the help of soil scientists, woodland conservationists, range conservationists, and other resource specialists from the Soil Conservation Service, Oklahoma Wildlife Department, Oklahoma Forestry Department, and other agencies.

Payne County Conservation District helps organize and support an environmental studies program at the

Left, (standing, left to right) John Mills, principal of Stillwater Middle School; Don Jackson, district conservationist, Stillwater; (sitting, left to right) Margaret Swank, Payne County Conservation District board member; Robert Hale, superintendent of Stillwater Middle School; and Terry Shaw, teacher at Stillwater Middle School, review plan for 3 days of outdoor activities at Camp Redlands a few miles from Stillwater. Below, three students at Camp Redlands perform water studies.



Stillwater Middle School. Each year sixth graders spend 3 days at Camp Redlands on Lake Carl Blackwell studying soil, water, and other resources.

Some districts sponsor essay, poster, and speech contests. Others hold conservation fairs and give awards for displays and projects. Since 1946, Oklahoma districts have sponsored an annual land judging contest for Future Farmers of America and 4-H chapters.

Several conservation districts in the State have formed youth boards, made up of high school students who attend conservation district board meetings, organize conservation projects, and study conservation practices in their counties.

More than 200 outdoor classrooms have been established throughout Oklahoma. Clair Fickett, chairman of the Tulsa County Conservation Board, and most other district leaders feel that working with schools and universities will pay environmental dividends.

Mr. Phillips is public information officer, SCS, Stillwater, Okla.

Members of youth boards from Valliant and Guthrie, Okla., tour a strip mine in the eastern part of the State.

Students in southern Illinois no longer have "flood drills," thanks to a levee that solved their school's flooding problems.

by Robert E. Craft

No More Flood Drills

Heavy rains do not alarm the students at the Egyptian Community Unit School in Mounds, Ill. The 950 youngsters stay in their classrooms and continue studying, undisturbed by the falling rain. But it hasn't always been that way.

Not long ago, flood drills were as common as fire drills at Egyptian. At the sound of a bell, all the students from kindergarten through 12th grade filed through the halls and onto the gymnasium stage and bleachers —the two highest points in the school building.

There was a good reason for these drills. The school had been flooded in 1971, and during Memorial Day weekend in 1973, floodwaters rose to 32 inches throughout the building.

After the water subsided in 1973, 4 inches of sediment covered the floors, and over $300,000 of damage had

Above, Barry Gowin (left), Egyptian School superintendent, and Ed Pawlisch, district conservationist, review plans for RC&D flood prevention measure.

Left, after a flood in 1973, 4 inches of silt covered the school floors—over $300,000 of damage had been done.

been done to books, furniture, equipment, and the school building itself.

After that, flood drills were routine and plans for flood prevention became a priority at Egyptian.

"Now," according to Barry Gowin, Egyptian school superintendent, "we don't need to have our students file to the gym to be safe from floodwaters, thanks to the community improvement project of the Shawnee Resource Conservation and Development (RC&D) Area."

Working through the Shawnee RC&D Area, the Soil Conservation Service prepared an engineering and environmental plan for protecting and improving the school and the local resources.

The Pulaski-Alexander Soil and Water Conservation District, the Egyptian Community Unit School District No. 5, and the Illinois Division of Transportation's Division of Water Resources took part in the project.

Today, a levee 7 feet high surrounds the Egyptian school building. It has wide, gently sloping sides, and protects the school against flooding.

A few parents were against the flood protection project because they thought the levee would make the building look like it was set in the middle of a big hole. "Avoiding that was one of the main objectives in designing and building the levee," explains SCS District Conservationist Ed Pawlisch.

The parents are all in favor of the results. The wide banks of the levee were shaped to blend with the surrounding landscape and planted with more than a thousand trees and shrubs.

Additional benefits of the flood protection project are the numerous trees and shrubs planted in patterns that make it easy to use the scenic surroundings as outdoor classrooms. Also, wildlife are attracted to the natural settings.

The total cost of the project was $587,000. School Superintendent Gowin believes the project is invaluable: "In March of this year we had heavy rains again. In one downpour, 7 inches of rain fell. Without the levee, there would have been close to 24 inches of water inside the school. But with the levee our students were safe and the school stayed dry."

Mr. Craft is public information officer, SCS, Champaign, Ill.

Edward Masterson (left) and Thomas Poston, SCS construction inspectors, review construction plans.

Flood control measures at Egyptian School include a concrete drop structure and pipe outlets. Riprap prevents streambank erosion.

Tammy Kinnebrew uses a conservation plan for managing his woodland and saves hardwoods for wildlife.

by Earl J. Garber

A Close Look at Tree Harvest

"Knowing where every tree is and where it's going during and after harvest is the only way to make money growing trees," said Tammy Kinnebrew as he monitored timber harvesting on his pine plantation near Homer, La.

Kinnebrew, a semiretired lawyer, has been cooperating with the Saline and D'Arbonne Soil and Water Conservation Districts since 1949. In fact, he displays in his office conservation plans the Soil Conservation Service helped him develop for his farm.

Beginning in the fall of 1976, Kinnebrew thinned nearly 300 acres of loblolly pines—the first thinning of more than 300,000 trees he planted in 1959 and 1960. He used a combination of ideas from SCS, the Louisiana Experiment Stations, and other sources in thinning the stand.

"I began by removing every third row of trees," Kinnebrew said. He found, however, that this left his plantation easy prey to ice damage during the winter. He tried removing every fifth row, but the results still didn't satisfy him. Kinnebrew then decided to remove every seventh row and thin the remaining rows to a D+6 spacing, leaving a space equal to the average diameter plus 6 feet between each tree.

"I think it is better to remove fewer trees on the first round and come back with a second thinning sooner," he explained. "Since a certain number of trees will be lost to natural causes like ice damage, why increase the losses by removing too many trees?"

Kinnebrew also owns almost 700 acres of native pines and hardwoods. He uses the D+6 spacing in harvesting the native pines for pulpwood and sawlogs, but he refuses to cut any hardwoods on his farm because of their value to wildlife.

Kinnebrew marks most of the trees to be cut himself. He doesn't mark more than 1 day ahead for the pulpwood cutters so he is always working in the same area as the cutters.

Kinnebrew employs a crew who cut pulpwood only for him. "This way I can control the size of the equipment and the rate at which they harvest," he explained. The cutting goal for an average week is 90 cords, using three trucks that each haul 6 cords a day.

By letting a wood company estimate the amount of timber in the stand, bid on it, mark it, and cut it, Kinnebrew could get $2 or $3 more a cord. He believes, however, that he is saving by harvesting only those trees that are not suitable for producing sawlogs and by reducing damage to the remaining trees.

"I generally have an agreed-to price per cord, or per thousand board feet, with the woodyard. I feel that this method is better than estimating the volume and contracting a sale because there is no guesswork involved," Kinnebrew said.

"My method of harvesting timber may not fit small landowners, but this is where a cooperative is needed," he continued. "The small landowners must get together and pool their resources. A cooperative would aid not only in harvesting but also in marketing their product."

Kinnebrew recommends that tree farmers with small as well as large operations request technical assistance from their local soil and water conservation district, SCS, and State Forestry Commission. But, he added, "A tree farmer has got to stay close to his crop, especially when it's being harvested. If not, carelessness could mean the difference between profit and loss."

Mr. Garber is district conservationist, SCS, Ville Platte, La.

Virgin Islanders Compete to Aid the Environment

by William G. Saalman III
and Carol F. Smith

Recent legislation in the U.S. Virgin Islands is living up to its popular name, "Earth Change Law."

Urged on by the Virgin Islands Conservation District, which received technical advice from the Soil Conservation Service, the legislature passed the 1971 Environmental Protection Law to control development in the islands.

Soil and water conservation is especially needed in the three main islands—St. Thomas, St. John, and St. Croix—because of the steep, hilly terrain and lack of a generous natural water supply. Recent development has shifted natural drainage patterns and increased flash flooding and the amount of sediment deposited in natural drainageways and low areas.

Under the new law, landowners planning any development must agree to carry out conservation measures to keep erosion at a minimum, protect existing vegetation, deal with storm drainage, and conserve surface runoff. Only then will the district or the Department of Conservation and Cultural Affairs issue them an earth change permit. SCS assists with planning and gives technical advice on installing conservation measures.

In 1976, popular support for the law increased with the first annual awards for outstanding conservation measures. Winners were selected by the conservation district and the Virgin Islands Resource Conservation and Development Council.

The 1977 awards went to eight winners in the following categories: single-family residence, hotel-condominium, government, commercial/business, subdivision, industry, and special. Each winner receives a plaque, and photographs of the event are used in newspapers and in a conservation exhibit at the annual Food and Agriculture Fair.

"People like to be recognized for their efforts," said Clifford Benjamin, the conservation district chairman. "Our award winners have all helped significantly to enhance and protect our tropical environment."

With the support of the Virgin Islands Conservation District, more than 3,300 Earth Change Permits have been issued on the islands by the Department of Conservation and Cultural Affairs since the law first took effect in October 1972. An estimated 2,500 acres have been affected by the conservation program.

Mr. Saalman is district conservationist, SCS, St. Croix, V.I.
Ms. Smith is clerk-typist, SCS, St. Croix, V.I.

Meetings:

November	
6–9	Irrigation Association Convention, New Orleans, La.
7–9	Geological Society of America, Seattle, Wash.
8–11	Future Farmers of America, Kansas City, Mo.
13–16	National Forest Products Association, San Diego, Calif.
13–17	American Institute of Chemical Engineers, New York, N.Y.
13–18	American Society of Agronomy, Los Angeles, Calif.
13–18	Soil Science Society of America, Los Angeles, Calif.
14–22	The National Grange, Greensboro, N.C.
15–16	Purdue Air Quality Conference and Exhibition, Indianapolis, Ind.
23–26	National Council for Geographic Education, St. Louis, Mo.
29–Dec. 1	Western Forestry and Conservation Association, Seattle, Wash.
30–Dec. 2	Keep America Beautiful, Inc., National Meeting, New York, N.Y.
December	
4–6	American Society of Farm Managers and Rural Appraisers, Inc., Denver, Colo.
5–9	American Geophysical Union, San Francisco, Calif.
12–13	Erosion and Sedimentation Symposium, Chicago, Ill.
January	
3–6	Catfish Farmers of America, Atlanta, Ga.
8–12	American Farm Bureau Federation, Houston, Tex.
8–12	National Council of Farmer Cooperatives, San Francisco, Calif.
9–13	North American Game Breeders and Shooting Preserve Association, San Antonio, Tex.
17–21	National Wool Growers Association, Inc., Denver, Colo.
24–26	National Cattlemen's Association, New Orleans, La.

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